# Administrative Change

An administrative change to this directive was approved on 7-26-05. In accordance with the Departmental Directives System:

> *Administrative changes are simple changes that do not substantively affect the directive. Examples of such changes are nomenclature changes to organization names or titles of officials, changes to legal citations, and minor reductions in requirements and responsibilities.*

To see the redlined/strikeout of changes for this administrative change, please go to http://www.directives.doe.gov/reference/rso46111.pdf.

**DOE M 461.1-1**

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# PACKAGING AND TRANSFER OF MATERIALS OF NATIONAL SECURITY INTEREST MANUAL


## U.S. DEPARTMENT OF ENERGY
## Washington, D.C. 20585

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All Departmental Elements

**INITIATED BY:**
Office of Defense Programs

# PACKAGING AND TRANSFER OF MATERIALS OF NATIONAL SECURITY INTEREST MANUAL

## FOREWORD

This U.S. Department of Energy (DOE) Technical Manual is authorized by the Assistant Deputy Administrator for Military Applications and Stockpile Operations and is available for use with DOE O 461.1A, *Packaging and Transfer or Transportation of Materials of National Security Interest*, dated 4-26-04, by all DOE components and their contractors and laboratories, who are responsible for the transportation of nuclear explosives and the packaging and transfer of special nuclear material, nuclear components, and special assemblies on a DOE-controlled site.

All DOE facilities are required to develop and implement an Onsite Packaging and Transfer Procedure detailing both the means by which those facilities will comply with the requirements of DOE O 461.1A, which governs transfer and transportation of specific materials, and the packaging or container used to minimize the risk of release of those materials to the public, the worker, and the environment. This Technical Manual provides mandatory and appropriate site-specific approval processes for technical safety requirements and policy objectives for development of an Onsite Packaging and Transfer Program, which each contractor must document in its Onsite Packaging and Transfer Procedures. This Technical Manual, when implemented, satisfies the requirements of 10 CFR Part 830, Subpart B for all DOE nuclear facilities.

This Technical Manual is not intended to define the format or the exact content of the DOE contractor Onsite Packaging and Transfer Procedures. The variation in DOE facilities, functions, and level of hazard dictates that each DOE contractor and laboratory organization define the structure and level of documentation required for its own Onsite Packaging and Transfer Program. DOE contractors are encouraged, but not required, to consolidate the documentation required by DOE O 461.1A, this Technical Manual, and other DOE packaging and transportation Orders, regulations, and Manuals into one series of plant or site manuals.

This Technical Manual is published to provide a means by which sufficiently stringent, but practical, Onsite Packaging and Transfer Procedures can be established to maximize the protection of the public, the worker, and the environment from the hazards associated with the onsite transfer of nuclear explosives and the onsite packaging and transfer of special nuclear material, nuclear components, and special assemblies.

Beneficial comments (recommendations, additions, or deletions) should be addressed to—

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# PACKAGING AND TRANSFER OF MATERIALS OF NATIONAL SECURITY INTEREST MANUAL

1. PURPOSE. The purpose of this Technical Manual is to establish requirements for operational safety controls for onsite operations. This Technical Manual provides Department of Energy (DOE) technical safety requirements and policy objectives for development of an Onsite Packaging and Transfer Program, pursuant to DOE O 461.1A, *Packaging and Transfer or Transportation of Materials of National Security Interest,* dated 4-26-04. The DOE contractor must document this program in its Onsite Packaging and Transfer Manual/Procedures.

   This Technical Manual provides minimum technical safety requirements for the design, acceptance, and use of onsite containers for the staging and onsite transfer of special nuclear material, nuclear components, and special assemblies. The design and development of suitable container configurations remains the responsibility of the DOE site or facility. Nuclear explosives will be transferred onsite utilizing the requirements for handling equipment as identified in DOE O 452.2B, *Safety of Nuclear Explosive Operations*, dated 8-7-01. Staging is defined as the temporary co-location of items onsite in preparation for a storage, transfer, or offsite transportation operation.

   Onsite transportation safety documentation prepared in accordance with section 5 of this Technical Manual satisfies the requirements of 10 CFR Part 830, Subpart B, Section 830.204, "Documented Safety Analysis," and Section 830.205, "Technical Safety Requirements," for all onsite transfers within hazard category 1, 2, and 3 DOE nuclear facilities.

2. SCOPE. This Technical Manual describes requirements that apply only to onsite packaging and transfer activities at DOE facilities that retain and transport nuclear explosives, per DOE O 452.2B, *Safety of Nuclear Explosive Operations,* dated 8-7-01, and special nuclear material, nuclear components, or special assemblies, pursuant to DOE O 461.1A.

3. BACKGROUND.

   a. Nuclear Explosives. Nuclear explosive operations require additional special safety consideration because of the potential high consequence of an accident or unauthorized act. DOE O 452.2B provides a complete safety program for nuclear explosive operations. The Order requires that each operations office have a comprehensive program for the safety of nuclear explosive operations that integrates nuclear explosive safety (NES) requirements with other safety requirements. DOE O 452.2B further specifies that the requirements for the safety of nuclear explosive operations may be implemented through the Integrated

Safety Management approach. This Technical Manual does not change or establish additional requirements for onsite nuclear explosive operations.

b. Special Nuclear Material, Nuclear Components, and Special Assemblies. Special nuclear material and nuclear components are staged and transferred onsite in approved container configurations (including Type B containers) via site-specific transporters specifically designed for onsite transfer. Special assemblies, such as Nuclear Explosive-Like Assemblies, are often transported on approved handling equipment.

4. OBJECTIVES.

a. Responsibilities. The requirement to establish onsite packaging and transfer requirements is the responsibility of DOE field organization managers. Nothing in this Technical Manual is intended to alter this line management administrative responsibility. Instead, this Technical Manual provides a means by which DOE requirements can be established to maximize the protection of the public, the worker, and the environment from nuclear explosives, hazardous nuclear components, special assemblies, and special nuclear material that must be transferred onsite. The requirement for field organization managers to have a comprehensive program for the safety of nuclear explosive operations, including onsite packaging and transfer, is established by DOE O 452.2B. This Technical Manual does not change or establish additional requirements for onsite nuclear explosive operations, including the NES responsibilities of DOE field organization managers.

Further, this Technical Manual prescribes that a containment system be provided for all handling, staging, and transfer configurations. ["Containment system" means the assembly of components of the package specified by the designer as intended to retain the radioactive materials during transport and/or transfer.] All onsite restraint configurations must be evaluated against performance-based standards to ensure the continued safety of nuclear explosives, special nuclear materials, nuclear components, and special assemblies while they are handled, staged, or transferred onsite. A performance-based packaging is an approved, quality-controlled, hazardous material container that has been tested or analyzed to demonstrate its ability to maintain confinement and/or containment of its contents under both normal use and "credible onsite accident conditions." The use of offsite transportation performance-based packaging criteria is an acceptable means of providing risk mitigation for all onsite transfer and staging operations on a DOE site [see Title 10 of the Code of Federal Regulations (CFR) Part 71 and Title 49 CFR Parts 100–185].

It is the responsibility of the DOE site to document "credible onsite accident conditions" for their various site transfer and staging operations and to implement positive measures, including performance-based packaging, to mitigate credible onsite risk to the worker, the public, and the environment. For the transfer and

staging of nuclear explosives, where substantial revisions to the transfer and staging configuration are impractical or otherwise precluded, the DOE site must document positive measures weighted more toward onsite accident event mitigation, consistent with the requirements of DOE O 452.2B.

b. General Site Objectives. Each site is required to document its compliance with this Technical Manual or provide an equivalent alternative as approved by the appropriate DOE authority. The following general objectives apply to the onsite transfer of nuclear explosives and the onsite packaging and transfer of all nuclear components, special nuclear materials, and special assemblies (e.g., contents) governed by DOE O 461.1A.

(1) Promulgate technical safety requirements using a graded approach to significantly reduce aggregate risk to site workers, the public, and the environment.

(2) Develop a site-specific performance-based packaging evaluation program founded on technical safety requirements tailored to site-specific operations using national industry standards. Due to the inherent explosive hazard, such criteria may not be feasible for the transfer and staging of nuclear explosives.

(3) Transfer all contents onsite in vehicles and handling equipment that have been specifically approved by the cognizant field organization manager. Vehicles shall be periodically (e.g., annually) validated as acceptable for conveying hazardous material contents in conformance with applicable Department of Transportation (DOT), state, and local vehicle regulations.

(4) Package and transfer onsite materials in site-specific configurations that have been approved by the cognizant field organization manager and have been tested, documented, and demonstrated to be in compliance with site-developed, performance-based, technical safety requirements, as outlined in this Technical Manual. Compliance with DOT, Nuclear Regulatory Commission (NRC), or DOE packaging requirements satisfies the requirements of this paragraph, and specific approval of the field organization manager is not required.

(5) Store, stage, and transfer nuclear explosives only in configurations approved by the required nuclear explosive safety study.

(6) Develop, track, revise, and evaluate onsite packaging operations for each site in accordance with the DOE site-approved Quality Assurance Program (QAP). A distinctly separate QAP for site packaging and transfer operations is discouraged.

5. TECHNICAL SAFETY REQUIREMENTS. Field organization managers shall use the safety requirements in Appendix A in developing the technical safety document and the

assessment methodology for the graded safety approach for each type of onsite packaging and transfer of all nuclear components, Category I and II SNM, and special assemblies governed under DOE O 461.1A. Field organization managers will consider the safety requirements in Appendix A in developing operational safety controls for nuclear explosive onsite transfer operations as an element of the comprehensive program for the safety of nuclear explosive operations. This comprehensive program shall maximize the protection of the public, the worker, and the environment from the hazards associated with the onsite transfer of nuclear explosives and ensures that the Nuclear Explosive Safety Standards and other criteria of DOE O 452.2B are met.

These technical safety requirements will apply to all onsite packaging and transfer configurations, as approved in the DOE site-specific Onsite Packaging and Transfer Safety Manual/Procedures, pursuant to DOE O 461.1A. DOE recognizes that the hazardous materials onsite transfer requirements for special nuclear materials, nuclear components, and special assemblies may differ from the modal transportation conditions established in the Federal Regulations; for example, Normal Conditions of Transport (NCT) in 10 CFR 71.71 and the Hypothetical Accident Conditions (HAC) in 10 CFR 71.73. DOE sites may use a graded approach to onsite packaging and transfer in which nuclear explosives, nuclear components, special assemblies, and radioactive materials are first grouped into a series of hazard levels followed by selection of onsite packaging and transfer requirements appropriate for the particular hazard level. A transfer configuration is defined as a system or equipment approved for onsite transfer (e.g., nuclear explosive within or on a handling gear), which doesn't resemble the general physical appearance typically attributed to a hazardous material container or a package.

DOE G 460.1-1, *Implementation Guide for Use with DOE O 460.1A, Packaging and Transportation Safety*, dated 6-5-97, provides guidance for Environmental Management hazardous material shipments. DOE G 460.1-1, section 5.3, "Technical Safety Documentation," and section 5.4, "Assessment Methodology," are edited, reproduced, and provided in Appendix A as safety requirements. Note that Appendix A has been edited to ensure that the requirements and responsibilities established in DOE O 461.1A are applicable. Facilities shall use the safety requirements in Appendix A in developing the technical safety document and the assessment methodology for the graded safety approach for each type of onsite transfer of nuclear explosives, under DOE O 452.2B, and the onsite packaging and transfer of all nuclear components, special nuclear materials, and special assemblies (e.g., contents) governed under DOE O 461.1A.

Equivalence methodology can be based on packaging performance tests and/or analysis, administrative and operating controls, or a combination of these. The technical safety document summary shall substantiate the conclusion that any credible incident will not cause any individual to receive a committed effective dose greater than 5.0 rem. This is the basis for the DOT and NRC packaging requirements in 49 CFR 173 and 10 CFR 71 [see International Atomic Energy Agency (IAEA) ST-1, and ICRP Publications 26 and 30]. Also, DOE sites must specifically analyze fissile material transfers and develop safety documentation that demonstrates both the administrative and operating controls that would prevent a criticality event in all credible onsite transfer and staging incidents.

Specific, approved, technical safety documents shall be referenced in the DOE contractor's Onsite Packaging and Transfer Procedures.

The following requirements apply to the conduct of onsite packaging or transfer operations:

a. All onsite packaging shall be inspected for form, fit, and function prior to use.

b. All radioactive material shall be transferred in a manner that minimizes worker contact and environmental release in accordance with current DOE Orders.

c. All packages and transfer configurations shall be marked and/or labeled to categorically identify hazardous materials. In addition, special assemblies shall be permanently marked as specified in DOE O 452.2B.

d. Onsite packaging and transfer configurations shall be designed (or current configurations validated) to meet or exceed each site-specific onsite performance-based criterion. These criteria must be addressed in the site-specific Onsite Packaging and Transfer Procedure. These criteria shall include the following:

(1) Packaging and transfer configuration must be water- and corrosion-resistant to preclude significant structural or material degradation through the absorption of water into any part of the packaging or transfer configuration, or thinning or embrittlement of base metal, welds, and fasteners.

(2) Packaging or transfer configuration must be secured so that it will not move or shift within the designated onsite conveyance, which could cause it to be damaged or marred during transit.

(3) Packaging or transfer configuration must be designed so that any designated lifting attachment on the packaging or transfer configuration, when used in the intended manner, will have a minimum safety factor of three to the yield stress of the material and will not impose an unsafe stress on the structure of the packaging; possible lifting points not intended for use as a lifting attachment shall be documented to prevent improper use.

(4) Packaging or transfer configuration must be designed to withstand the effects of buckling, fatigue, denting, or general weld or connection failure; protrusions and occupationally hazardous extensions shall be avoided to the maximum extent practicable.

(5) Packaging or transfer configuration must be designed to permit the application of a seal or other security or accountability feature when required.

(6) Packaging or transfer configuration design must ensure that the operation complies with the site-specific personnel radiation program.

(7) Packaging or transfer configuration must use materials that can be easily decontaminated for those surfaces normally accessible to radioactive contamination.

(8) Packaging or transfer configuration must be designed to withstand the effects of vibration that may arise during normal onsite operations without deterioration of the integrity of the package or transportation configuration, or loosening of fasteners or securing devices, even after repeated use.

(9) Procedures must designate suitable fabrication materials that will ensure that the packaging or transfer configuration and contents are physically and chemically compatible.

(10) Packaging or transfer configuration must be able to withstand all conditions of transfer without leading to substantive increase in radiological exposure, reducing criticality safety, or releasing radioactive or other hazardous material contained within the packaging.

(11) Packaging or transfer configuration must be engineered to mitigate the retention of heat that could lead to packaging or transfer configuration materials of fabrication and content degradation, thereby minimizing the potential of hazardous material release.

e. Onsite Transfer Vehicles.

(1) Transfer vehicles used onsite shall—

(a) be designed and assembled in compliance with U.S. standards as of the date of manufacture (examples of the Federal Motor Carrier Safety Regulations that can be mirrored for onsite operations, as applicable and appropriate, include 49 CFR 390-399);

(b) be systematically inspected, repaired, and maintained (to manufacturer's specifications, General Services Administration requirements, and site-specific requirements);

(c) have a documented daily or pre-trip inspection;

(d) be adequate for the size, weight, and type of material transferred;

(e) be designed and assembled to accommodate the tiedown; and blocking and bracing methods used during transfer.

(2) Transfer vehicle operators of onsite vehicles shall—

(a) meet facility medical and physical qualification requirements to operate a transfer vehicle as specified in the site Transportation Manual;

(b) demonstrate by testing the knowledge and skills necessary to operate the transfer vehicle. This testing shall be performance based (e.g., as demonstrated by written and practical demonstration testing). The testing shall demonstrate the ability to operate vehicles and emergency equipment and to conduct pre-trip inspections and emergency actions. The testing shall also be conducted periodically to verify that the operator continues to perform his responsibilities adequately;

(c) receive training in the physical and chemical characteristics of the material transferred; and

(d) receive training in the facility hazard communication and emergency response notification requirements for the materials transferred, as described in Title 29 CFR 1910.1200, Hazard Communication, Appendix E, Employee Information and Training, and Title 10 CFR 835, Occupational Radiation Protection.

(3) Transfer vehicle operating infrastructure shall—

(a) be of a roadway design including marking, signs, and operating instructions on the route of onsite transfer in accordance with acceptable U.S. standards or recommendations;

(b) include docks and platforms compatible with the vehicle(s) used and materials being transferred; and

(c) be examined to determine maximum transfer vehicle operating speeds that must be communicated to the operator.

(4) Onsite transfer material handling equipment shall—

(a) be adequate for the dimension, weight, and characteristics of the materials transferred;

(b) be purchased and maintained to appropriate U.S. standards or design criteria; and

(c) not consist of tools likely to damage the effectiveness of the closure of any package being transferred, loaded, or unloaded.

(5) Transfer vehicle operations conducted onsite shall—

(a) be performed over approved and designated routes;

(b) have the option of using escort vehicles to ensure satisfaction of administrative and communicative controls;

(c) be operated according to facility requirements and an approved plan for the transportation activity to be performed;

(d) have an inclement weather vehicle operating policy;

(e) require that hoisting, tiedown, and blocking and bracing be accomplished in accordance with appropriate U.S. standards or design criteria (see DOE-STD-1090-96 (Rev.1), Hoisting and Rigging, and Title 49 CFR 393.104, Blocking and Bracing Requirements);

(f) not transport hazardous materials cargo in the vehicle operator's compartment;

(g) not transport passengers other than those authorized while material is being transported and not transport any passengers in the cargo containment of the transfer vehicle;

(h) have a policy that provides for "stop transfers" when safety or operating concerns are identified; and

(i) have a policy providing for the maximum driving time permitted by transfer vehicle operators.

(6) Hazard communication devices on the packages and transfer vehicles shall—

(a) be durable, legible, unobscured by labels or attachments; and located away from other communications that could substantially reduce their effectiveness (see Title 49 CFR 172, Subparts D and E);

(b) be compatible with all other hazard communication requirements;

(c) be printed on or affixed to the surface of a package or vehicle with a label, tag, or sign on a background of sharply contrasting color;

(d) communicate the physical and chemical hazards associated with material transferred; and

(e) be a hazard communication system addressed in training of all the employees at the facility.

(7) Material transfer emergency planning and response organizations shall—

(a) establish a response plan for the transfer activities; and

(b) establish emergency response capabilities to respond to transfer accidents and incidents.

(8) Compliance with Title 49 CFR 100-185 will satisfy the requirements of this Technical Manual.

f. Onsite Packaging and Transfer Safety Procedures. Each facility or site shall prepare onsite procedures detailing the responsible organizations and the relationship among affected contractor organizations that interface to implement the Onsite Packaging and Transfer Program for Materials of National Security Interest. These procedures shall be prepared for the use of site contractor(s) and shall be maintained and updated by onsite packaging and transfer line management. The procedures shall be approved by the cognizant field organization manager and shall establish the foundation for DOE appraisals and self-appraisals of onsite transfer of nuclear explosives and the onsite packaging and transfer of special nuclear material, nuclear components, and special assemblies. The Onsite Packaging and Transfer Procedures for Materials of National Security Interest may be separate or part of the site's entire Packaging and Transportation Manual, which defines the site program for all packaging and transportation operations conducted onsite. These Onsite Packaging and Transfer Procedures shall—

(1) include site-specific technical safety requirements for onsite packaging and transfer hardware and systems;

(2) describe nuclear explosive transportation configurations and special nuclear material, nuclear component and special assembly onsite packaging and transfer configurations (including a listing of operating procedures or instructions), and operating restrictions and system limitations of approved onsite configurations;

(3) describe the Onsite Packaging and Transfer Configuration Restraint Testing Program and methods of testing used at the site or, where restraint testing is not required, the standard for restraints (e.g., DOT, NRC, IAEA, DOE Tiedown Guidance; ANSI N14.2, *Commercial Vehicle Standards*); include a list of references to the site safety assessment documenting the onsite packaging or transfer configuration restraint system tests for each approved onsite configuration;

(4) describe approved transportation routes (including areas of possible public access) and method(s) of limiting access;

(5) delineate authorized staging areas for the packaging and transportation of materials of national security interest;

(6) coordinate with the site occurrence reporting program, including emergency response information briefly outlining hazards mitigation measures, the reporting and tracking process, and report closure process. The responsible organizations shall be described in detail along with the time-scale for action based on occurrence severity in accordance with DOE unusual and emergency occurrence directives;

(7) describe administrative controls, marking, and labeling procedures that effect and ensure comprehensive hazards communications;

(8) include an outline of required qualifications and training for each worker or management function and identify the period and level of participation before required requalification. This description shall be consistent with the site-wide programs for training and requalification developed to address policy and objectives found in the DOE-approved contractor training program;

(9) list documentation and retention requirements and contractor organizations responsible for maintaining records of onsite transfer; and

(10) use appendices and other pertinent information of immediate value to the onsite operator, including but not limited to—

(a) examples of labels and markings and descriptions of seals;

(b) examples of site material transfer documents (onsite shipping manifest), along with several pertinent samples of correct completion;

(c) site-wide procedures and instructions applicable to all onsite transfer operations;

(d) lists of approved packaging or transportation configuration restraint systems used for nuclear explosives, special nuclear materials, nuclear components, and special assembly onsite shipments;

(e) lists of definitions, references, and acronyms, and a glossary;

(f) maps (public and onsite roads, rail crossings, and other hazards or boundaries); and

(g) examples of occurrence reporting, vehicle maintenance, and other relevant forms.

g. Safety Controls and Documentation. Technical safety documents that identify safety controls and documentation required to establish the safety envelope for each transfer shall be developed and then approved by the cognizant DOE field element. These technical safety documents shall identify deviations from the Hazardous Materials Regulations and document equivalent safety measures that mitigate these deviations. The hazard assessment process required for nuclear explosive operations is described in DOE O 452.2B. This process and the required NES study ensure that the implementation of a requirement to prevent or mitigate an onsite packaging or transfer hazard does not result in a NES concern.

# APPENDIX A

## PREPARATION OF TRANSPORTATION SAFETY DOCUMENTS AND SAFETY ASSESSMENT METHODOLOGY

1. INTRODUCTION. DOE M 461.1-1, *Packaging and Transfer of Materials of National Security Interest*, dated 9-29-00, requires that deviations from Department of Transportation (DOT) Hazardous Materials Regulations for each type of onsite transfer be documented in an approved site-specific technical safety document. This document describes (explicitly or by reference) the methodology and compliance process to meet equivalent safety measures that mitigate deviations from the Hazardous Materials Regulations. This technical safety document is expected to—

   a. identify responsibilities, lines of authority, and program approval procedures;

   b. define minimum safe packaging requirements, including necessary design, fabrication, and quality assurance elements, using appropriate codes and standards, and the minimum standards established in DOE M 461.1-1;

   c. describe transfer systems and operational controls used to restrict personnel and public access and minimize the probability and consequence of credible accidents;

   d. describe the process and analysis used to ensure that equivalent safety requirements are established. This shall include a technically justified basis for equivalency to permit the use of current basis for interim operation (BIO) and/or safety analysis reports (SARs) on any transfers and any facility loading and unloading. For example, this could include hazards analysis associated with the transfer, an assessment of the risks associated with the transfer, and a discussion of the mitigating measures proposed to ensure the equivalent safety requirements will be employed. This analysis would be performed for each deviation from the Hazardous Materials Regulations;

   e. describe the site, including maps identifying boundaries, railways, and roadways, clearly delineating offsite and onsite areas and areas of public access;

   f. include procedures for clearing and establishing access control for any area having occasional public access;

   g. describe procedures for effective emergency response and recovery under credible accident conditions; and

   h. describe a process for accomplishing packaging and transfer activities requiring special handling (non-routine).

DOE M 461.1-1, which was implemented by DOE O 461.1A, *Packaging and Transfer or Transportation of Materials of National Security Interest*, dated 4-26-04, requires that each technical safety document be approved by the cognizant DOE field element. Approval shall constitute acceptance of the site program and acknowledgment that it meets DOE transportation safety requirements. This is a new requirement, but existing site programs may remain in effect until this requirement is met. DOE O 461.1A states that no later than 6 months from the date that the Contractor Requirements Document is incorporated into the contractor's contract, a plan should be submitted to include the requirements of this Order in the contract, unless an exemption has been applied for and granted. Upon approval, all onsite transfers shall be conducted in accordance with this implementation plan as soon as all necessary procedural changes can be made.

2. PREFERRED FORMAT FOR PACKAGING AND TRANSFER TECHNICAL SAFETY DOCUMENTS. The following is a preferred format for technical safety documents. The level of detail required in each technical safety document depends on the complexity of operations, number and location of workers at the site, quantities and types of materials being transported, number and complexity of site transport routes, and need for special controls (including safeguard controls) to meet DOE transportation safety requirements. Sites that already have a well-developed technical safety document do not need to rewrite their documents to this format; instead, they may provide a crosswalk from the existing format to this one and add relevant sections where needed. However, existing technical safety documents lacking significant amounts of information and therefore requiring significant revision must be revised to be consistent with this format.

a. Chapter I, Purpose, Scope, and Applicability.

(1) Purpose. State that the technical safety document documents the Onsite Packaging and Transfer Program and demonstrates its compliance with DOE transportation safety requirements.

(2) Scope. State that the technical safety document covers all transfers of nuclear components, special assemblies, and radioactive materials. ("Transfer" means any onsite transport of nuclear explosives, special nuclear material, nuclear components, special assemblies, or associated radioactive and hazardous materials, which involves movement of material from one facility to another.)

(3) Applicability.

(a) Describe how the requirements of the document apply to site and facility operations so that someone who must move hazardous material can understand whether the requirements of the document apply to the movement in question.

(b) State who is responsible for controlling document distribution and preparing and distributing document updates.

(c) Explain how controlled distribution and maintenance of the document will be accomplished.

b. Chapter II, Definitions and Acronyms.

(1) Define all terms or acronyms used in the technical safety document that are relevant to onsite packaging and transfer operations.

(2) Define unfamiliar site-specific terms for the benefit of new employees or external reviewers of the document.[1]

c. Chapter III, Site Description.

(1) Maps. Provide enough information to enable a reader unfamiliar with the site (e.g., a new employee or an independent reviewer) to comprehend all site-specific discussion in the technical safety document.

(a) Identify the physical location of the site and associated facilities on legible maps.

(b) Mark site boundaries clearly.

(c) Identify fences and other restrictions to public access.

(d) Clearly identify on one or more maps all features of the site mentioned in any part of the document, such as facilities, buildings, entryways, storage areas, transport routes, and transportation hazards; reference the appropriate maps when mentioning site-specific features in the text.

(2) Vehicles. Either list the transport vehicles used for onsite hazardous materials movements or indicate the location where that listing will be provided.

d. Chapter IV, Organizational Responsibilities.

(1) Describe the packaging and transportation organizational structure within the framework of the entire site organization. The inclusion of organization charts is encouraged for clarity.

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[1]Reference to definitions from ORNL-M-3077, *Transportation and Packaging Resource Guide*, December 1994, would be helpful.

(2) Clearly describe the authority and responsibilities of principal organizations and key positions within those organizations so that lines of authority and reporting may be understood.

(3) Demonstrate independence of oversight organizations.

(4) Cite program approval procedures.

e. Chapter V, External Regulations.

(1) Reference the principal Federal, state, and local regulations, DOE Orders, and other requirements affecting onsite packaging and transfer activities including those imposed by organizations external to the site organization.

(2) Provide a complete description of all the externally imposed requirements with which the onsite packaging and transfer activities must comply.

(3) Identify any Government and industrial standards used as benchmarks in developing the Onsite Packaging and Transfer Program.

f. Chapter VI, Site-Specific Standards, Procedures, and Instructions.

(1) Identify site-specific standards, procedures, and instructions applicable to onsite packaging and transfer activities.

(2) Present only the general requirements governing the development of specific procedures for individual hazardous material transport activities.

(3) List applicable codes and standards that support any packaging standards, performance criteria, and design, fabrication, and quality elements identified in this chapter.

(4) Identify and/or reference site-wide procedures for subjects such as securing of loads and tiedown, load compatibility, contamination and radiation exposure control, and criticality control.

(5) Reference all relevant site policy and procedures documents (e.g., radiological protection manuals and health and safety manuals).

g. Chapter VII, Safety Assessment Methodology. Describe the methodology used to achieve and demonstrate compliance with DOE O 461.1A, paragraph 4b; include any probabilistic or risk-based approaches used. Guidance on developing and applying a safety assessment methodology is provided in section 2 of this appendix. This guidance recommends development of a hazardous materials hierarchy and associated performance requirements and documentation of these requirements in this chapter. The primary emphasis of the onsite packaging and transfer system for hazardous materials should be placed on packaging design and

packaging performance to ensure containment of materials during routine onsite transfer activities. Well-designed packaging can reduce both the probability and the consequences of a hazardous material release for a given package handling scenario.

h. Chapter VIII, Routine Transfers. Identify the major categories of hazardous materials or hazard classes routinely transferred onsite, the packagings used for each, and the specific procedures followed. The procedures may cover such topics as identification and classification of material, packaging selection, packaging preparation and use, transport vehicle scheduling and use, hazard communication, hazard control, and routine approvals.

i. Chapter IX, Non-Routine Transfers.

(1) Define the procedures for processing and approving a request for an exception to the routine transfer requirements of Chapter VIII in accordance with DOE O 461.1A. Also, see DOE O 461.1A, paragraph 4i.

(2) Address the required format, content, and control of this type of request, conditions under which approvals shall be sought and given, approval authorities, maintenance of documentation, period of approval, and exclusions. Except under emergency conditions, approval shall be granted only after the proposed transfer has been formally evaluated in a safety assessment.

j. Chapter X, Personnel Qualification and Training.

(1) Define or reference the training requirements for personnel involved with onsite nuclear component, special assembly, and/or radioactive materials packaging and transfer activities.

(2) Identify required courses, course content, testing, and qualification requirements for various packaging and transportation personnel as a function of the jobs to be performed.

(3) Specify requirements for documenting training, qualification, and recertification.

k. Chapter XI, Documentation and Record Keeping.

(1) Identify all site-specific documentation to be maintained to support the onsite transfer safety program. Records requirements shall include retention of such items as packaging documentation [e.g., Safety Analysis Reports for Packaging (SARPs), test reports, or other packaging evaluations], personnel training and qualification records, vehicle

maintenance and inspection records, and documentation associated with both routine and non-routine transfers.

(2) Specify what records must be maintained, who is responsible for maintaining the records, how the records are to be stored, and how long the records are to be retained. Records retention determinations must be based upon a National Archives and Records Administration (NARA)-approved records disposition schedule. The General Records Schedules (GRS) issued by NARA are authoritative, as NARA-approved Department of Energy Records Schedules (DOERS). Consult the DOE or DOE contractor cognizant records management officer for guidance on applying the appropriate records disposition schedule(s) to the subject records or for scheduling previously unscheduled records.

l. Chapter XII, Incident Reporting and Emergency Response.

(1) Describe incident reporting and emergency response plans for the site.

(2) Define the lines of communication and the roles and responsibilities of key personnel involved in an emergency response or incident report.

(3) Reference relevant procedures.

(4) Describe measures to ensure planning is adequate to cover all credible emergency situations to ensure effective response and recovery after a transport accident or incident.

m. Chapter XIII, Transport Vehicle Operations.

(1) Identify or reference maintenance and inspection requirements and associated procedures for onsite vehicles.

(2) Identify routine operator duties and procedures.

n. Appendices and Other Pertinent Information. Use this section to include additional site-specific guidance to assist transport operations, such as—

- examples of labels, markings, placards;
- site material transfer documents (shipping papers);
- lists of packagings (packaging directory);
- maps (roads, railways, site boundaries, facilities, crossings, adjacent streams, waterways and wetlands);
- incident reporting forms;

- vehicle maintenance forms; and
- other forms.

3. SAFETY ASSESSMENT METHODOLOGY.

a. Use of a Graded Approach. DOT regulations are structured so that materials representing a greater hazard are subject to greater containment, communication, and control requirements. DOT regulations may be applied to onsite transfers to ensure compliance with the Order. If DOT regulations are not used to ensure compliance with the Order for onsite movements, a graded approach to hazard management may be established through the use of such means as testing to meet onsite transport hazards, administrative controls, and escorts.

A site seeking to establish a graded approach to compliance with DOE O 461.1A shall develop a hierarchy in which nuclear components, special assemblies, and radioactive materials are grouped into a series of hazard levels. For each hazard level, the performance requirements for the transfer system (where the transfer system consists of the packaging plus the controls and communication requirements imposed on its movement) shall then be established. For materials representing low hazards, the transfer system would be expected to prevent loss of containment during routine onsite handling and may also be expected to survive minor mishaps. For higher hazards, the transfer system would be expected to withstand more severe handling without loss of containment. For materials such as Type B radioactive materials, the transport system would be expected to prevent loss of containment both for routine handling and for all credible onsite accidents.

The performance requirements imposed on each hazard level in the hazardous materials hierarchy shall be documented in Chapter VII of the technical safety document. This documentation shall enable a site to establish containment, control, and communication requirements for onsite movements in a consistent and justifiable manner, and shall ensure that requirements established for an onsite movement will be commensurate with the hazard of the material being transported (i.e., nuclear component, special assembly, and/or radioactive materials).

b. Safety Assessment. Reliance on packaging performance is the preferred way to ensure overall safety; however, an integrated approach that considers the packaging in combination with specified communication and control measures is also acceptable. Table A-1 presents the options available to a site for complying with DOE O 461.1A and indicates the evaluations that would support each. As a first step, the packaging shall be placed into one of three categories: (1) DOT-compliant packaging, (2) DOE-equivalent packaging, or (3) non-equivalent packaging.

- DOT-compliant packaging is packaging that meets the regulations of DOT for offsite shipment.

- DOE-equivalent packaging is packaging that can be shown conclusively to provide performance equivalent to packaging meeting the requirements of DOT for offsite shipment. Packaging falling into this category will generally be a slight modification of a DOT-compliant packaging or a Defense Programs packaging. An example may be a package approved by the DOE Office of Licensing or the National Nuclear Security Administration Service Center's Packaging Certification Division.

- Non-equivalent packaging is any packaging that cannot be demonstrated to be either DOT-compliant packaging or DOE-equivalent packaging.

**Table A-1. Available Options for Complying with DOE O 460.1B**

| **Type B Quantities**<br>**Is the packaging . . .** | | |
|---|---|---|
| **DOT?** | **Equivalent?** | **Non-Equivalent?** |
| Document this. | Demonstrate packaging equivalence. | Establish performance envelope of the packaging and evaluate the transfer system (including controls and communication).<br>Demonstrate that the system operates safely within the performance envelope. |
| **Type B Quantities**<br>**Are controls and communication . . .** | | |
| **Full DOT?** | **Site-specific?** | |
| Full DOT? Document this. No additional evaluation required. | Demonstrate that transfer conditions provided by onsite controls are not more severe than would be encountered offsite. Demonstrate adequacy of communication with personnel and emergency response team. | |

As the table shows, DOT-compliant packaging requires no special evaluation. It need only be documented as approved packaging. Equivalent packaging shall be supported by a documented evaluation in which this equivalence is formally established. Once established, equivalent packaging may be used interchangeably with DOT-compliant packaging for onsite movements.

Still following the logic of Table A-1, DOT-compliant packaging and DOE-equivalent packaging may be used onsite in two ways. First, they may be used in compliance with all DOT control and communication requirements for offsite movements. The use of full

DOT/DOE control and communication requirements shall be documented in the technical safety document. No further evaluation is then required. Second, these packagings may be used with site-specific control and communication requirements. To ensure that DOE O 461.1A is met, the site-specific requirements shall be evaluated to demonstrate that (1) transfer conditions provided by the onsite controls are no more severe than would be encountered by a package being transferred offsite and (2) personnel potentially involved with the transfer and emergency response teams receive adequate communication regarding the hazards involved with the transfer.

The final option represented in Table A-1 involves the use of non-equivalent packaging. Because this packaging has not been demonstrated to function equivalently to DOT/DOE packaging, the use of full DOT/DOE control and communication requirements may not be adequate for this type of packaging. Before non-equivalent packaging may be used for onsite transfer, a performance envelope will be established for the packaging and specific control and communication requirements will be developed that ensure that the transfer system will operate safely within the performance envelope.

The evaluation of the transfer system described in Table A-1 shall take the form of a safety assessment. The safety assessment may be straightforward or very complex, depending primarily on the packaging to be used for the hazardous materials movement. As a first step, the packaging shall be evaluated and placed into one of the three categories described earlier: (1) DOT-compliant packaging, (2) DOE-equivalent packaging, or (3) non-equivalent packaging. The details of the required evaluation then follow from Table A-1.

The safety assessments for routine onsite hazardous materials movements may be documented in Chapter VIII of the technical safety document or as stand-alone documents referenced in Chapter VIII. The process by which safety assessments for non-routine transfers are performed, documented, and approved shall be described in Chapter IX of the technical safety document. Documentation of the safety assessment may cover the following topics:

(1) Description. Thoroughly describe the onsite hazardous material movement to be evaluated. The hazardous material to be transported shall be stated and its hazard level indicated. Site-specific details, such as transport routes, shall be described where appropriate.

(2) Packaging. Describe the packaging to be used for the onsite transfer and categorize it as follows:

(a) DOT-Compliant Packaging. For DOT/DOE packaging, reference the appropriate DOT/DOE standard and any packaging test report or other documentation that demonstrates that the packaging is approved for offsite shipment of the hazardous material to be transferred onsite.

(b) DOE-Equivalent Packaging. For equivalent packaging, reference the DOT/DOE packaging to which this packaging is equivalent and provide supporting evidence to demonstrate equivalence.

(c) Non-Equivalent Packaging. For non-equivalent packaging, provide a detailed analysis of the packaging in which the performance envelope of the packaging is clearly established. To establish the performance envelope of the packaging, evaluation of design basis conditions (DBCs) is recommended. DBCs will be site-specific and possibly include route-specific conditions under which the packaging shall be able to provide containment during onsite transfer. DBCs to be considered for a particular hazardous materials transport will depend on the hazard level of the material. Chapter VII of the technical safety document shall include instructions on which DBCs shall be developed for each hazard level and shall establish minimum performance requirements for each hazard level. Examples of DBCs that may be appropriate for some hazard levels are shock, vibration, collision, fall, fire, penetration, and immersion. Others may also be appropriate. To illustrate how the performance requirements established in Chapter VII of the technical safety document can be used to develop an appropriate DBC, a particular hazardous material may be grouped into a hazard level that requires a packaging to be able to survive a 3-foot drop with no loss of containment. For this hazardous material, a 3-foot drop would then become the DBC for falls, without regard to conditions along the transport route or during handling that might expose the packaging to a fall from a higher distance. If the packaging could not survive a 3-foot drop, additional administrative controls would need to be imposed on the transport system to ensure an adequate level of safety during transfer. Chapter VII of the technical safety document shall provide instructions regarding appropriate administrative controls.

As an example of how physical limitations of a site may be incorporated into a DBC, a particular hazardous material may be grouped into a hazard level that requires a packaging to be able to survive a 30-foot drop. For this particular hazardous material shipment, an evaluation of the transport route may show that, for any accident that could occur along the transport route, the packaging could never fall more than 10 feet. If a control on the packaging is also imposed requiring that the packaging never be elevated more than 10 feet during handling, the DBC need consider only a 10-foot fall.

(3) Controls. Describe the controls to be placed on the onsite hazardous materials transfers shown in Table A-1; full compliance with DOT control and communication requirements for offsite transport is an option unless a non-equivalent packaging is being used. The full compliance option may be documented with no further evaluation. (The DOT tiedown and vehicle requirements would need to be imposed for a hazardous materials transport to be

in full compliance with offsite DOT regulations.) For DOT or equivalent packaging, the other option is to provide site-specific controls. These controls need only ensure that the packaging will not be exposed to transport conditions any more severe than the packaging would experience during an offsite shipment.

For non-equivalent packaging, controls shall be commensurate with the hazard represented by the package being transported, and shall ensure that the packaging operates within its established performance envelope. The hazard levels and associated performance requirements documented in Chapter VII of the technical safety document will greatly facilitate development and justification of appropriate transport controls. Controls may include establishment of special communication requirements (e.g., radio contact with emergency response personnel) that are required to compensate for packaging inadequacies.

(4) Communication. Describe the communication requirements for the onsite hazardous material transfer. Again, Table A-1 shows that full compliance with DOT communication and control requirements for offsite transport is an option for DOT and DOE-equivalent packaging. This option may be documented with no further evaluation. Full DOT/DOE compliance would include strict adherence to use of DOT/DOE packaging as well as all DOT/DOE marking, labeling, placarding, and shipping papers requirements. The other option for DOT and DOE-equivalent packaging is to develop site-specific communication requirements. Because the purpose of the DOT/DOE marking, labeling, placarding, and shipping papers requirements is to communicate the hazards of the nuclear components, special assemblies, and radioactive materials being transferred to personnel handling these components and/or assemblies and to emergency responders in the event of an accident, sites may develop other methods of communication with personnel involved with the transfer and with emergency response personnel. For non-equivalent packaging, communication requirements need to be established and evaluated as part of the entire transport system. The system shall be shown to provide equivalent safety. As with the establishment of all transfer requirements, communication requirements shall be commensurate with the hazard of the material being transported. Justification for communication requirements can best be provided on the basis of the performance requirements documented in Chapter VII of the technical safety document. In some cases, special communication requirements will be described as part of the control requirements for the transfer. Such requirements shall be repeated here.

(5) Conclusion. The safety assessment shall conclude that, based on the evidence provided, the transfer system provides a level of protection commensurate with the hazard of the material being transferred.